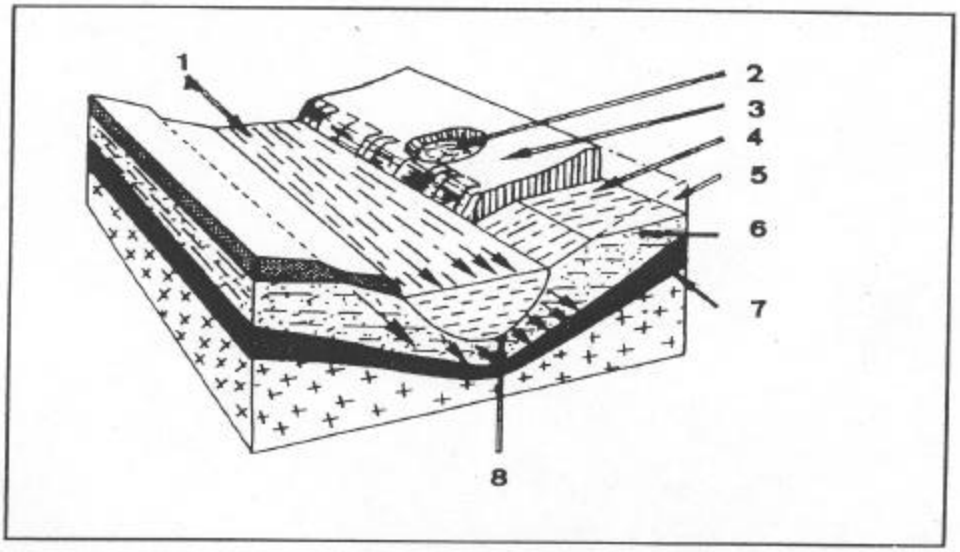
Community Conservation Assessment for Hyporheic Habitat and Associated Rare Animal Species



Phreatic river in permeable alluvions diagram. 1- Stream. 2- Sample. 3- Bank. 4- Subterranean stream. 5- wet permeable alluvions. 6- Saturated permeable alluvions. 7- impermeable level. 8- biological membrane. (After Delamare-Debouteville, 1960)

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Julian J. Lewis, Ph.D.
J. Lewis & Associates, Biological Consulting
217 W. Carter Avenue
Clarksville, IN 47129
lewisbioconsult@aol.com

HOOSIER NATIONAL FOREST

This Conservation Assessment was prepared to compile the published and unpublished information on the hyporheic habitat and associated rare animals species in the Hoosier National Forest. It does not represent a management decision by the U.S. Forest Service.
Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve the hyporheic communities.

DESCRIPTION OF HABITATS AND COMMUNITY

Three kinds of non-cave subterranean groundwater habitats occur in Indiana that are being termed here as: (1) epikarstic – shallow aquifers that occur at the limestone/soil or limestone/sandstone contact; (2) interstitial – water that occurs in the interstices of unconsolidated deposits such as alluvium or till, not related to karst; and (3) hyporheic – water that occurs under, or perhaps to the side of (parafluvial) surface stream channels, not related to karst.

The hyporheic habitat concerned here consists of groundwaters flowing through interstitial pore spaces in unconsolidated sediments that form the bottom and sides of stream channels. Put more simply, this is the groundwater that flows through sand and gravel beds below the visible parts of streams. The subterranean animals that inhabit such interstices may be termed phreatobites.

In Indiana a hyporheic habitat sampled from a gravel bar along the Blue River with a Bou-Rouche pump has demonstrated an extraordinary fauna including the following obligate subterranean organisms: snail Fontigens cryptica, copepod Diacyclops undescribed species (yeatmani group), isopod Caecidotea jordani, amphipod Crangonyx packardi and a bathynellid new to science that remains undescribed. All of these white, eyeless organisms were found at a depth of about one meter below a very ordinary appearing gravel bar.

ENVIRONMENTAL CONDITIONS

Camacho (1992) defined characteristics for the phreatic environment:

(1) Sediment grain size – The size of the constituent particles establishes the porosity of the habitat and is the limiting factor as to what kinds of animals can exist in the interstices. At some point there is a minimum threshold below which the pores in the sediment are too small to accommodate animals.
(2) Light—According to Pennak (1950) all light disappears with 10 centimeters of the surface. Thus no plant life occurs in the habitat and the animals present in this environment have morphological adaptations similar to animals living in caves.
(3) Water flow rate—Phreatic water flow is not static, there being an interplay between surface and subsurface waters. The current is also dependent upon the size of the sediment grains (determining porosity), the heterogeneity of the sediment, and the degree of compaction. Angelier (1962) stated that flow velocity

decreased with increasing depth, as vertical movement decreases and laminar flow increases.

(4) Temperature—Surface waters respond to environmental changes on a constant basis. The temperature of the underlying groundwater is a function of the temperature of the surface water supplying it. However, the effect of surface temperature decreases with depth underground and in the deepest groundwater layers the temperature is practically constant and independent of daily or seasonal fluctuations.

(5) Dissolved oxygen—Of the many who have studied the oxygenation of phreatic groundwaters, there is no consensus as to how the constraining factors determining dissolved oxygen levels work. In general dissolved oxygen is a function of temperature. The concentration varies with depth and permeability of the sediment and the rate at which it is being renewed.

(6) Dissolved solids—The level of dissolved solids which determines pH, alkalinity, etc. is determined by the chemical nature of the ground through which the water is flowing, and varies tremendously from site to site.

(7) Organic matter—Organic matter is abundant on the surface and decreases with depth into the ground. The presence of decomposing organic matter determines the level of reduction in the environment, thus affecting dissolved oxygen levels. Evidence indicates that due to the contained nature of the habitat, organics persist in phreatic groundwaters significantly longer than in free flowing waters characteristic of surface streams.

CURRENT COMMUNITY CONDITION, DISTRIBUTION AND ABUNDANCE

In the Hoosier National Forest hyporheic communities remain basically undetected, although they are certainly present.

REGIONAL FORESTER SENSITIVE SPECIES

At present there are no species listed as Regional Forester Sensitive Species from hyporheic habitats on the Hoosier National Forest.

POTENTIAL THREATS

Due to the close proximity to the surface hyporheic aquifers are particularly susceptible to contaminants from both the overlying stream and parafluvial flow. Potential contaminants include (1) sewage or fecal contamination, including sewage plant effluent, septic field waste, campground outhouses, feedlots, grazing pastures or any other source of human or animal waste (Harvey and Skeleton, 1968; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al. 1996, 1997, 1998); (2) pesticides or herbicides used for crops, livestock, trails, roads or other applications; fertilizers used for crops or lawns (Keith and Poulson, 1981; Panno, et al. 1998); (3) hazardous material introductions via accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Crawford, 1985; Lewis, 1993, 1996).

SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

Significant quantities of hyporheic habitat is certainly present on the Hoosier National Forest, but unsampled. The primary way to ascertain the presence of subterranean fauna is by placing Bou-Rouche pumpwells for sampling (Popisil, 1992).

SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

No specific activities are currently being conducted concerning hyporheic communities.

RESEARCH AND MONITORING

A bioinventory of subterranean habitats of the Hoosier National Forest is being conducted, although sampling hyporheic habitats is beyond the scope of that project (Lewis, et al., 2002; and in progress).

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